FOREWORD

These Procedures for the inspection of Fire Alarm Systems are designed to assist inspection authorities with the inspection of fire alarm systems in their jurisdictions.

While this document will not cover all situations you may encounter, it is designed as a tool to be used for reference when necessary when conducting an inspection.

In addition to being a handy tool for use by inspectors and plan checkers, this document may also serve as reference material for courses conducted which refer to State Fire Marshal's Fire Alarm Regulations.

I hope that you will find these procedures of assistance as you perform your day-to-day fire prevention functions.

For further information or questions about this document and its content, please contact our Technical Services Division, at (916) 262-1936.

RONNY J. COLEMAN
Chief Deputy Director
State Fire Marshal

FIRE ALARM SYSTEMS AND INSPECTION PROCEDURES

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FIRE ALARM SYSTEMS AND INSPECTION PROCEDURES

PART I, FIRE ALARM FUNDAMENTALS

INTRODUCTION

Until recent years, fire alarm protection has been largely limited to three general areas of application:

TRADITIONAL FIRE ALARM APPLICATIONS

1. Municipal manual street box systems to provide a means for the public to summon the fire department.

2. Automatic fire detection systems with alarm signaling connections to some remote type of monitoring facility for protection of commercial and industrial properties.

3. Life safety evacuation alarm systems comprised of manual fire alarm boxes and bells in school and health care facilities.

The life safety aspect of fire protection has become a major factor only within the past two decades as a result of significant revisions in state and local codes.

CURRENT TRENDS IN FIRE ALARM

There are a number of reasons for the substantial increases in the life safety form of fire protection during recent years. Primarily these are:

1. The proliferation of high-rise construction and the concern for life safety within these buildings.

2. A growing awareness of the life safety hazard in residential, institutional, and educational occupancies.

3. Increased hazards caused by new building materials and furnishings which create large amounts of toxic combustion products, (i.e., plastics, synthetic fabrics, etc.).

4. Vast improvements in smoke detection technology.

5. The Federal ADA (Americans with Disabilities Act), which provides for equal access and protection for disabled persons.

In most instances, the burden of enforcement and inspection of the rapidly increasing numbers of life safety fire protection systems lies with the local fire service.

With somewhat limited experience in such systems, the fire inspector may lack the necessary expertise for adequate evaluation.

This may inadvertently result in the approval of sub-standard installations, which do not fully provide the intended protection or comply with the applicable codes and standards

There has long been a growing concern for this problem, both within the fire service and the fire alarm industry.

PUBLICATION OBJECTIVES

This publication was originally developed in 1983 as a joint venture by an Ad-Hoc Fire Alarm Advisory Committee to the State Fire Marshal and the California Automatic Fire Alarm Association in an effort to help resolve the problem.

It was then published as appendix "D" of the State Fire Marshals' Handbook.
The objectives were to promote a better understanding of fire alarm systems in general and also to provide specific guidelines for meaningful inspection procedures so as to assure reasonable compliance with acceptable installation standards.

The Handbook is no longer published, but the problem of inadequate fire alarm knowledge still persists among some inspection authorities and descriptive information remains an urgent need.

Therefore in August 1994, the standing Fire Alarm Advisory Committee to the State Fire Marshal appointed a sub-committee to revise and upgrade the original text to reflect current standards and code requirements.

It should be noted that the descriptions of fire alarm systems are based upon the vast majority being installed at the time of this revision in January of 1995, and as specified by the 1993 edition of NFPA 72, The National Fire Alarm Code.

Some variations in control units will be found during inspections, but the differences should be minor, such as the types of annunciation, types and locations of pilot lamps or equivalent visual indicators, types of control switches, and manufacturer's identifications.

Such minor variations are relatively insignificant and should not present a problem when encountered.

Parts lll and lV of this document provide suggested checklists for use by the inspector during the course of the inspection.

These forms may be revised as appropriate to suit local jurisdictional requirements. It is recommended that copies be used for reference during all routine fire alarm inspections.

TYPES OF FIRE ALARM SYSTEMS

NFPA 72, the National Fire Alarm Code identifies seven types of private fire alarm installations, these are:

Household Fire Warning Equipment
Local Fire Alarm System
Emergency Voice/Alarm Communication System
Auxiliary Fire Alarm System
Remote Station Fire Alarm System
Central Station Fire Alarm Service
Proprietary Fire Alarm System

There is also one municipal fire alarm system identified as a Public Fire Alarm Reporting System which consists of manually operated municipal fire alarm boxes on street corners or other strategic locations with direct signaling connections to the fire department dispatch center.

While very common in the first half of the 20th century, most of these systems have been discontinued due to the substantial maintenance costs, frequency of malicious false alarms, and the availability of telephones as a reliable alternate means of reporting fire emergencies.

One major exception is in the New England area where such systems are still extensively used.

The seven types of private fire alarm systems have many features in common, but also some distinct differences. The major distinction in types is essentially related to the form of signal generated in response to an alarm or possible trouble condition.

The alarm signal format is based upon the primary intent of the system with respect to providing either life safety or property protection.

Any fire alarm system will provide both life safety and property protection to some extent, but one or the other will have priority based upon the system design.

Those designed primarily for life safety are intended to alert building occupants and have no requirements for remote signaling connections to summon the fire department unless local codes specify otherwise.

In contrast, those intended primarily for property protection are designed to alert the responsible fire department through appropriate remote signaling connections, but have no requirements for an audible alarm to alert building occupants. Such systems are most frequently installed to monitor automatic sprinkler systems in compliance with code requirements or may often involve insurance interests.

Three of the private systems are primarily dedicated to life safety and four are basically intended for property protection.

It should be noted that with only one exception, NFPA standards do not specify the type of protection to be provided by any of these systems. Such requirements are instead specified by applicable codes, the Authority Having Jurisdiction (AHJ), or both.

The one exception is the Household Fire Warning System, in which one or more smoke detectors are required for residential sleeping areas in compliance with Section 2-2.1.1 of NFPA 72 and as specified in Section 310.9.1 of the California Building Code.

LIFE SAFETY SYSTEMS

Local

The Local system is primarily dedicated to life safety and when activated, provides audible, and, when required, visual evacuation warning to building occupants.

There are no requirements for off-premises (remote) signaling connections unless specified by local codes.

The local system is the oldest of the life safety systems, having been commonly used in schools and health care facilities for several decades. The basic system consists of manual fire alarm boxes and bells.

With the availability of vastly improved smoke detection technology in the early 1970s, the code requirements for Local systems were rapidly expanded to include many other occupancies such as high-rise buildings, assembly, residential and additional institutional facilities.

The vast majority of fire alarm installations for which the fire service serves as the AHJ are local type systems.

This system has several operational variations, depending upon the applicable code and occupancy classification.

The most common is the general alarm type, with audible warning being sounded throughout the protected building to initiate total evacuation.

In health care or detention facilities in which occupants are totally dependent upon staff for relocation or possible evacuation, the system is usually a staff alerting type.

Unobtrusive audible devices such as chimes are used to alert staff personnel only. (Audible/ Visual signal devices for staff alerting are referred to in 1993 NFPA 72, as "Private Mode" signaling).

Another variation is "selective" evacuation in which audible warning will sound only in areas of alarm origin.

Examples are: the incident floor, floor above and floor below in a high-rise building or in a single building of a multiple building complex.

Where permitted by the authority having jurisdiction, there are also two types of systems in which the initial alarm will alert only key personnel and the general alarm warning is delayed pending investigation of the alarm source.

The Pre-signal system provides means to manually activate the general alarm if considered to be necessary and the Positive Alarm Sequence system automatically activates the general alarm after a predetermined period of time (not to exceed 180 seconds) unless manually aborted.

Prior to the 1993 edition of NFPA 72, there were no NFPA specifications for types of audible alarm outputs even though there has been an extensive variety including steady, pulsed, march time, coded, and temporal code three pattern.

The temporal code three pattern is now mandatory for all new installations after July 1, 1996 with two exceptions:

1. Staff alerting systems.
2. Emergency Voice/Alarm Systems

Appendix Figures A-3.7.2(a) (1), (2) and (3) of NFPA 72, 1993, illustrate the temporal code three pattern.

Emergency Voice/Alarm Communications

In comparison to other types of systems the Emergency Voice/Alarm Communication system is relatively new and was initially developed to address the unique problems presented in high-rise occupancies.

"The primary purpose is to provide dedicated automatic and manual facilities for origination, control, and transmission of information and instructions to the occupants (including fire personnel) of the building".

Total evacuation in a reasonable period of time, as typically initiated by the sounding of a general alarm throughout a building, is usually impractical.

The primary concern is to alert and relocate those occupants in the immediate vicinity of the fire as a preliminary priority measure.

The Emergency Voice/Alarm system was developed to fulfill this need and is intended to be used in combination with a Local system. The Voice/Alarm system supplements or replaces the usual bells, horns or similar audible devices used to sound the evacuation when an alarm is initiated.

By using speakers to sound an alert tone, followed by a pre-recorded voice message on the incident floor and usually the floor above and floor below, the voice/alarm system can direct occupants to safer areas via designated stairways pending the arrival of fire fighters.

The system can then be used for live voice messages on an all-call or selective call basis to provide appropriate evacuation instructions to occupants.

As noted earlier, Local systems do not normally require remote alarm signaling connections, but high-rise is an exception. The California amendment in Section 403.5.3.1 of the California Building Code requires that such systems be monitored by an approved Central Station, Remote Station or the fire department, unless the on premises central control station is constantly staffed in compliance with NFPA specifications for a Proprietary Alarm system.

The NFPA specifications for this system also include the criteria for a two-way fire-fighters phone system installed throughout the building.

Such systems are always required in high-rise. Two way radio communication is not always operable due to the materials used in the buildings construction.

While originally designed and intended only for high-rise application, the Voice/Alarm form of evacuation alarm is now also specified by NFPA 101 and all of the model building codes for Assembly Occupancies having mandated alarm requirements. (See Section 1007.2.2.2 of the California Fire Code).

For such applications they provide an alarm with message format rather than selective (relocation) as used in a high-rise and the optional two-way fire-fighters phone communication system is not required.

Household Fire Warning "Equipment"

Household fire warning can essentially be considered as the residential equivalent of the local system, in that the sole function is to alert the household occupants. There are no requirements for remote signaling connections unless required by the AHJ.

Since the alert warning can optionally be provided by a complete system or by single or multiple station smoke detectors as specified by Section 310.9.1 of the California Building Code, the term "equipment" rather than "system" is appropriate for the title.

Sub Section 310.9.1.3 specifies that in new construction the smoke detectors shall receive their primary power from the building wiring and be equipped with a battery backup.

This section would imply that the detectors must be supplied by AC house current, but the State Fire Marshal also recognizes low voltage DC powered detectors as meeting the intent of 310.9.1.3 when connected to a SFM listed Household Fire Warning Control Panel.

PROPERTY PROTECTION SYSTEMS

As previously noted, property protection systems are not required to provide audible or visual warning to building occupants.

Therefore, when one or more notification appliance is included with the system, they are classified as supplemental devices and the wiring connections to these devices would not require the usual monitoring for integrity (circuit supervision).

Auxiliary Systems

The Auxiliary system consists of electrical circuit connections between a fire alarm control panel

in a building and a trip coil in a municipal fire alarm box on a street corner or similar location.

When activated, the Auxiliary system electrically trips a municipal fire alarm box which transmits an alarm signal to the dispatch center in the same manner as when manually operated.

This is the oldest form of remote fire alarm signaling system and has very limited capabilities.

Until the fire department responds to the designated location, there is no means to determine whether the fire alarm box has been manually operated or electrically tripped by the interconnected building alarm system.

Only a summary alarm signal can be transmitted. If there are requirements for trouble, restoration, or other appropriate signals as are typical of other types of signaling systems, they must be transmitted by other means to an alternate monitoring facility approved by the fire department.

Due to the very limited number of jurisdictions which still maintain Public Fire Alarm Reporting Systems, Auxiliary fire alarm systems are now rarely installed.

There is no longer a designated chapter for the Auxiliary system in the 1993 edition of NFPA 72. Most of the specific requirements for Auxiliary systems are now in section 4-7 of that document.

Remote Station Systems

Until recent years, the signaling technology for central station fire alarm systems was distinctly limited in distances served.

Since central stations were usually restricted to larger cities in which business potential would justify the very substantial cost of such facilities, small towns, cities, and rural areas in which remote signaling connections were often needed, were beyond the range of central station service.

The remote station system was designed to fulfill this need and consists of signaling connections using dedicated leased telephone lines, terminating at the signal receiving equipment located in the fire department.

In those instances where fire departments decline to monitor such signals, they will designate alternate facilities as being acceptable.

In the past, the alternate facility would typically be a privately owned telephone answering service which would alert the fire department when alarm signals were received.

Currently, very few fire departments continue to accept direct monitoring connections, due in part to conflict with 9-1-1 combined fire/police/medical emergency dispatch centers.

Also, since the advent of digital communication technology, central station distance limitations no longer exist. Most remote station connections are now made to central stations, which re-transmit alarm signals to the fire departments.

Note: Such systems are still defined as "remote station" even though they are physically connected to and monitored by a "central station". Details are in the central station description.

Proprietary Systems

The proprietary system is one in which all signals are monitored by trained personnel in a supervised station in compliance with NFPA standards and located in a suitably isolated facility on the protected property.

Due to the significant cost of such a constantly manned facility, the proprietary system is generally limited to very large industrial complexes, or more commonly to college or university campuses and military reservations.

Central Station Service

The most significant difference between central station and other types of fire alarm is reflected in the title which specifies "service" rather than "system".

While a system is obviously involved, it may possibly be leased rather than owned by the property owner. There must be a contract with the alarm company for routine inspections and prompt maintenance when required, as specified in the applicable NFPA standards.

The alarm company must be UL listed or Factory Mutual Approved and must issue a UL certificate or post a Factory Mutual placard as evidence that the system is in full compliance with applicable NFPA standards.

While more than one alarm company may possibly be involved in the installation, maintenance and monitoring of the system, the company issuing the certificate or posting the placard assumes total responsibility.

It should be noted that only a very small percentage of fire alarm systems connected to central stations are in full compliance with NFPA 72 central station standards and can thus be classified as central station service.

Sometimes, remotely connected installations can be defined as Remote Station systems when 60 hours of standby battery capacity is provided, but much more frequently central station monitored installations are not fully in compliance with NFPA standards for either type and can only be classified as systems which are being remotely monitored.

This is typically true of most water-flow alarm and sprinkler supervisory installations, required by all three of the model building codes.

Since NFPA 101 Life Safety Code and all three of the model building codes have sprinkler-monitoring requirements, the vast majority of central station fire signaling connections consist of this type of service.

The California code requirements for water-flow and sprinkler supervision are specified in Sections 904.3 of the Fire Code and also Section 1003.1.1 of the Building Code.

It should be noted that Section 3-8.1.2 of NFPA 72 requires that an installation of either water-flow alarm or an automatic fire alarm detection system must include one fire alarm box, located where specified by the authority having jurisdiction.

Normally, as specified in Section 3-5.3, different types of initiating devices (i.e. water-flow switch and manual fire box) are not permitted on the same initiating device circuit. Exceptions 1 and 2 of Section 3-5.3 however, exempts the single fire box required by 3-8.1.2.

SECONDARY (STANDBY) POWER SUPPLIES

Another major distinction in types of systems is in the specified standby power requirements which are designed to ensure continued operation in the event of commercial power failure.

These specifications are in Section 2-3.4.4 of NFPA 72 for Household Fire Warning and Section 1-5.2.5 for all other types of systems.

SYSTEM TYPE	STANDBY HOURS	(Plus)	ALARM OPERATION
*LOCAL	24		5 Min.
* AUXILIARY	60		5 Min.
* REMOTE STATION	60		5 Min.
* PROPRIETARY	24		5 Min.
* CENTRAL STATION	24		5 Min.
* HOUSEHOLD	24		4 Min.
* VOICE/ALARM	24		2 Hours

Note: The requirement for 2 hours of alarm operation for voice/alarm systems, assumes selective or partial operation by area to relocate high-rise occupants. For standby battery calculations, 15 minutes of alarm operation at full load is considered to be the equivalent.

The foregoing types of systems as defined by NFPA are not always found in their pure forms and many occupancies contain composites of two or more types.

For example, the high-rise fire alarm system is basically a local system combined with or connected to an Emergency Voice/ Alarm system, but may also contain proprietary system manual control features and frequently requires Auxiliary, Remote Station, or Central Station monitoring of alarm signals.

FIRE ALARM FUNDAMENTALS - Basic Elements

Regardless of type, application, or complexity, any fire alarm system is comprised of four basic elements: (System Components)

a. Initiating Devices.
b. Control Unit.
c. Output Signals.
d. Power Supply.

These components must be electrically compatible and interconnected by means of suitable wiring circuits to form a complete functional system as illustrated in Figure 1 in the back of this document.

Operation: The initiating devices provide the means to activate an alarm and are connected to initiating circuits or signaling line circuits which are in turn connected to the control unit.

The control unit constantly monitors the status of these "input" circuits and initiating devices.

When an initiating device is activated, a change in electrical status will occur and is sensed by the control unit as an alarm condition.

The control unit will then operate appropriate output alarm signals to alert responsible personnel and/or occupants at the protected property.

The power supply furnishes the necessary electrical energy required by all the elements of the system.

In some instances, the control unit may also perform various other functions.

These optional functions are not classified as "fire alarm" and are therefore not considered as essential basic elements.

SYSTEM COMPONENTS - INITIATING DEVICES

Initiating devices are comprised of two basic types: Manual or Automatic.

Manual Devices

The manual device is defined as a manual fire alarm box and is the oldest form of initiating device.

The coded type of manual fire alarm box is designed to transmit distinctive coded signals to a remote location and is somewhat similar to the manual street box used in municipal systems.

This type of manual fire alarm box is usually intended to send a coded signal to the fire department and is rarely used in conjunction with a control unit to sound audible alarms or activate auxiliary functions.

The non-coded manual fire alarm box is the type most frequently used in alarm installations and always requires suitable circuit connections to a control unit.

Automatic Devices

The automatic initiating device is more commonly called a "detector" preceded by the particular product of combustion to which it is designed to respond.

Examples are: "heat" detector, "flame" detector, and "smoke" detector.

The only exception is the "water-flow" detector which does not respond to combustion products, but rather the flow of water through an automatic sprinkler riser as will occur when one or more sprinkler heads have operated.

Heat detectors are sometimes called "thermostats" or "thermal" detectors, and are available in two basic types with a number of variations in each:

a. Fixed Temperature
b. Rate of Rise

The fixed temperature heat detector is similar to the automatic sprinkler head in the respect that it is factory calibrated to operate at a specific temperature, and is color-coded to identify the operating temperature range.

Some models are self-restoring after operation while others require replacement.

The rate-of-rise heat detector is designed to respond to a rapid rise in temperature rather than to any specific temperature value and is self-restoring unless damaged. The rate of temperature rise is generally 15^{o} Fahrenheit per minute.

Since a smoldering or slow developing fire may not generate a rise of 15^{o} Fahrenheit per minute, most manufacturers include fixed temperature elements in rate-of-rise detectors to ensure detection capability under such conditions.

Flame detectors are designed to respond to the infrared or ultra-violet energy produced by a

spark or flame.

These detectors are usually confined to special applications such as extremely hazardous industrial processes and are rarely used for general fire alarm applications.

Smoke detectors generally provide the most rapid response to a fire and are available in several variations, but the ionization and photoelectric types are those most commonly used.

As a guide, both provide protection of a 30 by 30 foot square or 900 square feet of floor space, and are sometimes referred to as a "spot" type detector.

The photoelectric detector is also available in a projected beam type model.

The beam type is capable of protecting up to 20,000 square feet of floor space and is ideally suited for atriums and other areas in which spot type detectors are impractical.

SPRINKLER SUPERVISION

In installations where water flow detectors are installed to provide alarm indication of sprinkler operation, sprinkler supervision is usually included as a supplemental service.

Supervisory devices consisting of valve tamper switches or other sensing devices are installed to monitor critical elements of a sprinkler system and provide signal indication of any abnormal conditions which may develop.

Forms of Supervision

The most common form of this supervision is valve supervision, where a switch is installed on a sprinkler control valve to detect partial or complete closure of the valve.

The signal initiated as a result is not an alarm signal but a "supervisory" signal intended only to alert responsible personnel.

In more complex sprinkler installations, other available forms of supervision are as follows:

1. Water pressure.
2. Air pressure in pressure tanks, dry pipe sprinkler systems, or pre-action sprinkler systems.
3. Water level in reserve storage facilities.
4. Water temperature in reserve storage facilities.
5. Building air temperature when wet-pipe systems are used in freezing climates.
6. Fire pump power supply.
7. Fire pump running indication.

While supervision is most commonly applied to automatic sprinkler systems, it is not confined to this application and can also be applied to other types of automatic extinguishing systems such as Carbon Dioxide (CO_2), Dry Chemical, or Halon.

SIGNALING DEVICES

There are two general classifications of signaling devices, audible and/or visual, and transmitting.

Audible/Visual

The audible and visual devices are identified as "notification appliances" and are used primarily for life safety systems.

Notification appliances may consist of loudspeakers, bells, gongs, chimes, etc.

Where required by code or ADA, they will include strobe lights as a means to alert the hearing impaired.

Transmitters

Transmitters are most commonly used for property protection systems and consist of electro-mechanical or electronic devices designed to transmit signals to a remote monitoring facility.

Such signals are most commonly transmitted over telephone lines and less frequently by radio. Transmissions are done in a manner that will provide positive identification of their point of origin.

FIRE ALARM POWER SUPPLY

Primary Source

With rare exception, commercial power supplied by the municipality or public utility provides the primary source of power for the fire alarm system. This power is converted to a lower voltage to permit the use of limited energy wiring circuits.

It is also converted from AC to DC for compatibility with standby batteries, battery chargers and various other system components.

Secondary Source

Additionally, as previously noted, all systems require a secondary source of power.

This may consist of an emergency generator complying with applicable provisions of NFPA 110 and 72, but more often it will consist of standby batteries normally maintained under charge.

THE CONTROL UNIT

The control unit is essentially the heart of the system and serves as the interface between the input circuits and initiating devices, the output signaling devices, and the power supply.

Basic Functions

Control units vary in design, appearance, features, and options, but regardless of type or application, all are designed to perform the same three basic functions:

1. Monitor the status of the input circuits, initiating devices and power supply.

2. Monitor the installation for integrity, or as formerly termed, provide "electrical supervision"

3. Operate output signals when a change in status occurs.

The term "monitoring for integrity" pertains to assurance of reliability.

To avoid the possibility of an alarm system failure, the control unit is required to electrically monitor critical system elements such as the power supply and external wiring circuits to detect a fault condition which might cause the system to become inoperative.

When a fault condition such as damaged wiring is detected, the control unit will activate a trouble signaling output to alert responsible personnel.

The signal must be distinctly different from any alarm signal for positive identification as a "trouble" signal.

All types of fire alarm systems are required to detect failure of the primary power supply or failure of the battery charging source for the secondary supply, and fault conditions which may develop in external wiring circuits.

The requirement for monitoring of integrity does not apply to supplemental, non required, audible alarm devices installed in property protection systems, when their primary function is transmission of signals to a remote monitoring facility.

Auxiliary Features

In large fire alarm installations, annunciation must be provided to identify the source of an alarm.

Older installations and smaller ones will typically identify the alarm source by zone.

Zones are usually arranged by floors or structural divisions, such as area separation walls.

Zone identification is most frequently provided by visual indicators over designation strips, but other configurations may also be used.

For example, custom made graphic annunciators in which pilot lamps or equivalent visual indicators on plot-plans of the protected premises indicate the physical locations of related initiating devices.

Many annunciators provide both alarm and trouble indication by zones, with red lamps for indication of alarms and amber lamps for indication of trouble.

Newer systems, and particularly larger ones are often addressable types in which individual initiating devices are identified by type and location in English language alpha-numeric display annunciators. Trouble sources are similarly identified.

Printers are also sometimes used for annunciation and provide the added advantage of a permanent printed record of all events.

The visual annunciator is usually combined with the control unit in a single enclosure, but is not a required feature of the unit.

An independent annunciator at a separate location may also be used.

Fire Safety Control Functions

The Fire Safety Control Function is another auxiliary feature designed to activate any electro-mechanical functions which are appropriate for the particular hazard when an alarm is initiated.

Such functions may include but are not limited to the following:

a. Fire door release
b. Shutdown of HVAC systems
c. Closure of dampers
d. Opening of roof hatches
e. Operation of smoke exhaust fans
f. Opening of access gates
g. Pressurization of stairwells
h. Unlocking doors

An auxiliary relay connected to the fire alarm control unit and used to initiate control of fire safety functions must be located within 3 feet of the controlled circuit or device.

The installation wiring between these two points must be monitored for integrity. (i.e. Wiring between control unit and fan motor control panel for HVAC system.)

Exception: Control devices or auxiliary relays which operate on loss of power are considered self monitoring and do not require monitoring for integrity. (i.e. magnetic door holder circuit for fire doors.)

Ground Fault Detection

Another auxiliary feature of nearly all control units is ground fault detection.

This is a supplemental form of monitoring for integrity which is not always required, but is provided by most manufacturers.

The ground fault is an abnormal electrical connection established between electrical components of the alarm system and the earth or "ground".

Such a condition is usually due to a bare wire in contact with a metallic surface or moisture.

A single ground fault may not present a problem but more than one can cause a false alarm or impair the operation of the system.

Control units providing this feature will monitor the initiating, signaling line, and notification appliance circuits for ground fault detection and provide trouble indication of such a condition.

Local Control Unit Characteristics

The control unit for Local systems designed for life safety protection includes features which are not necessary nor required for a Property Protection System.

Standard Features

Standard control features found in all such control units are at least three status indicating pilot lamps or similar form of identification and three manual control switches which are accessible only to authorized personnel.

The colors of the indicating pilot lamps, when used, are most generally as follows, but variations may also be found.

GREEN (Power) Normally on, indicating normal connection of commercial AC power. Upon loss of power, the lamp will go off, accompanied by an audible and visual trouble indication.

AMBER (Trouble) Normally off. Will light, accompanied by an audible trouble warning when a system fault condition is detected.

RED (Alarm) Normally off. Will light accompanied by the sounding of the notification appliances when an alarm is initiated.

The three control switches are usually identified as "Reset", "Alarm Silence", and "Trouble Silence", but some variations in these terms may sometimes be used.

For example, the term "acknowledge" is sometimes used instead of silence.

RESET SWITCH When an alarm initiating device is activated, even if only momentarily, control units are designed to electrically "lock" or "latch" into alarm condition to ensure continuous sounding of the audible alarm devices and operation of strobe lights, if installed.

In order to silence the audible alarm and stop strobe light operation, the reset switch must be operated to restore the control unit to normal non-alarm status.

Some control units may require the reset switch to be operated for several seconds before the electrical locking feature is restored.

ALARM SILENCE SWITCH In the event the control unit cannot be reset following an alarm, due to the abnormal status of an initiating device or other causes, an alarm silence switch usually provides an alternate means of silencing the audible alarm and, where applicable, stop strobe operation.

In some systems alternate silencing methods such as keypad code entries may be provided to serve this purpose.

The red alarm indicating pilot lamp or equivalent form of annunciation, will remain on as a visual reminder of alarm status until the system can be reset.

TROUBLE SILENCE SWITCH When a system fault condition is detected, the trouble silence switch provides the means to silence the audible trouble warning until necessary repairs can be made.

The amber trouble indicating pilot lamp or equivalent annunciation must remain on as a reminder of abnormal status until repairs are completed and the system is reset to normal condition.

Most control units will restore to normal condition automatically upon completion of trouble repairs.

A few, however, are designed to electrically "latch" into trouble condition until reset.

Such units will usually provide two reset switches identified respectively as "Alarm Reset" and "Trouble Reset".

Trouble signals are required to sound when an alarm or trouble silence switch is moved to the off normal position when no alarm or trouble condition exists.

This is commonly identified as a "Ring Back" feature.

Optional Features

Optional Control Switches In addition to the three standard control switches, many control units will include one or more of the following optional switches:

Test or "Drill" Switch - The test switch simulates the operation of an initiating device.

The momentary operation of this switch may cause the control panel to lock into alarm condition

and operate the alarm notification appliances until the panel is reset.

Lamp Test Switch - The lamp test switch provides a means to momentarily light all the control panel pilot lamps including those used for annunciation, to verify that all are functional.

Disconnect Switch - Control panels which include Fire Safety Control Functions will always provide a "disconnect" or similarly identified switch to permit testing and servicing of the system without operating the control functions.

Depending upon the manufacturer, this switch may be identified as "Shunt", "Cut-Off", or "Auxiliary"

The operation of any disconnect switch to "Off" position will result in both an audible and visual trouble indication to serve as a reminder that the switch must be restored to normal "On" position.

This trouble indication serves as a form of switch status monitoring or "ring back feature".

Depending upon the types of switches used, the ring back feature may also apply to alarm silence switches in some control panels.

SPRINKLER SUPERVISION CONNECTIONS

Control units to which water-flow alarm connections are made will usually have additional requirements to monitor sprinkler supervisory devices.

Since such supervisory devices are not intended to initiate a fire alarm, but only to provide indication of abnormal sprinkler conditions, the control unit must provide a supervisory signal rather than an alarm or trouble signal when such a device is actuated.

Each individual form of sprinkler supervision must also be annunciated separately for distinct identification.

For example: one annunciation for control valves, another for reserve storage water level, another for fire pump power supply, etc.

HOUSEHOLD FIRE WARNING CHARACTERISTICS

While Household Fire Warning Equipment is also designed and intended primarily for life safety protection, there are a number of variations in concepts.

The vast majority of residential occupancies having such protection employ one or more single or multiple station smoke detectors. In some instances, they might be supplemented by one or more heat detectors.

The single station detector is a totally self-contained device including power source and audible signal device, and can be considered as a combination detector and control unit.

The multiple station detector is essentially the same, but is inter-connected with other multiple station detectors so that they all will provide audible warning when any one is activated.

All single or multiple station smoke detectors are required to be AC powered with a "Power On" indicator and monitored backup battery in new installations. Low voltage DC system type smoke detectors are also acceptable when connected to a State Fire Marshal listed Household Fire Warning Control Unit.

When installed as a remodeling requirement, detectors may be solely battery operated.

All require a test switch and some provide a "Hush" feature which will allow the detector to be de-

sensitized for up to 15 minutes.

The "Hush" feature cannot de-sensitize the detector to no more than 4% obscuration. It must be self restoring and give an indication of "off normal" while activated.

More extensive household fire alarm installations are usually comprised of system-type smoke detectors, possibly supplemented by heat detectors and requiring initiating circuit connections to a control unit.

Basically, the residential type control unit is similar to those used for Local Systems, but is somewhat simpler in design.

For example, alarm and trouble silencing switches are not required but when provided, must be supplemented by visual indicators.

The power on indicator is always a standard feature.

Many residential control units are combination types, accommodating both fire and burglar alarm protection.

The audible alarm for such a unit must sound one type of audible signal to indicate burglary and a distinctly different signal as an indication of fire, with the fire alarm signal taking precedence.

More complex residential fire alarm installations in R-1 occupancies use standard types of Local Alarm control units and manual stations for common areas, and usually employ system detectors in interior corridors and single or multiple station detectors for individual guest rooms or dwelling units.

FIRE ALARM SYSTEMS AND INSPECTION PROCEDURES

PART ll, THE ACCEPTANCE INSPECTION

In order to avoid any risk of liability for possible malfunctions or other problems evolving from the inspection, it is recommended that the fire inspector's participation be limited to specifying the tests to be conducted and observing and recording the results.

Any physical actions required in the performance of the tests should be conducted by the fire alarm contractor, building owner, or designated representative, hereafter referred to as the "technician".

As reference material, the inspector should have access to the adopted edition of the NFPA 72, National Fire Alarm Code and Part 3, Title 24, California Electrical Code.

These publications will be of value in resolving questions which may arise during the course of the inspection.

Except for corridors or other rectangular areas in which extended smoke detector spacings are permissible (Chapter 5, NFPA 72),the industry standard for spacing of smoke detectors on flat ceilings or those having beams or joists 8 inches deep or less, is 30 feet.

The spacing of heat detectors must be in compliance with both NFPA 72 specifications and the applicable State Fire Marshal listing data for the specific model installed. This data as well as evidence of current State Fire Marshal listing for all fire alarm components should be supplied by the technician.

Note: For the purposes of approval listing as specified by Title 19 CCR, Chapter 1.5, Section 204, fire alarm systems and devices shall not be construed to include any connected fire alarm or non-fire alarm equipment which is not essential to the function of the fire alarm system providing the fire alarm control unit or device complies with the provisions of Section 208(c).

Examples of such equipment include:

a. Municipal fire alarm systems.

b. Central Stations of central station systems.

c. Auxiliary or accessory equipment including but not necessarily limited to burglar alarm, recording, or other non-fire related sound reproducing equipment.

d. Telephones.

e. Retransmitting equipment commonly referred to as "dialers".

f. Auxiliary fire alarm boxes of auxiliary fire alarm systems.

g. Non-fire related equipment of computers used in fire alarm systems.

h. Remote station receiving equipment of remote station systems whether such equipment is located on or off the protected property.

i. Fire alarm wiring.

j. Supervisory devices for automatic fire sprinkler systems.

Caution: Some initiating devices are destroyed when tested, such as some models of fixed temperature heat detectors. It must be assumed that CSFM listing of these devices provides reasonable assurance of reliability and tests must be limited to momentarily shorting across the wiring terminals to simulate alarm activation.

PRELIMINARY PROCEDURES

Documentation

In addition to evidence of the required State Fire Marshal listing, the technician should supply the following information and documents prior to the inspection:

I. "As built" installation drawings.

II. Control Unit Data
- A. Wiring Diagram (usually affixed to inside of cabinet door);
- B. Operator's Manual;
- C. Classes of External Circuits - A or B and style classifications.
- D. Auxiliary Features
  1. Annunciation
  2. Fire Safety Control Functions
  3. Remote Signaling Connections
  4. Ground Fault Detection

III. Power Supply
- A. Source of AC Commercial Supply
- B. Stand-by capacity of secondary power supply.

IV. Initiating Devices
A. Locations
B. Quantities of each type
C. Evidence of listed spacing for heat detectors
D. Temperature classifications of fixed temperature or combination rate-of-rise fixed temperature heat detectors.
F. Evidence of UL compatibility listing for any 2 wire smoke detectors.

V. Signaling Devices
A. Audible and/or Visual Notification Appliances
  1. Locations
  2. Quantities
- B. Signaling Transmitters
  1. Monitoring Facility and Phone Number, if applicable.

VI. Special Features, if applicable
- A. Alarm Verification
- B. Cross Zoning
- C. Pre-Signal or Positive Alarm Sequence

Orientation

Before conducting any functional tests, the technician should be requested to explain the operation and features of the control unit, such as manufacturer's identification of control switches, indicating lamps, annunciation, auxiliary functions and any fire safety control features which might affect building functions, such as elevators, heating and ventilating, etc. Such orientation should provide a

degree of familiarity with the operation and intended functions of the system and assist in the evaluation of subsequent functional tests.

Notification

Personnel responsible for the premises to be inspected should be notified in advance and requested to advise all occupants.

On the day of the inspection, and prior to any functional tests, all concerned parties should again be notified, e.g.,

1. Building owner, manager, or responsible representative.
2. Maintenance engineer, security manager, PBX Operator,etc., where applicable.
3. All occupants, if applicable.

4. Any remote connected monitoring facility.
(Synchronize watches as clock turns over for later verification of signal transmission times.)

Appropriate signs announcing the test should be posted in all lobbies and elevators.

It is recommended that the fire department dispatch center be notified to avoid a possible false response.

INSPECTION SEQUENCE

There are no hard and fast rules for the preferred sequence ro use when conducting an inspection, but two general schools of thought prevail.

1. A complete visual inspection of system elements prior to any functional tests, based upon the premise that any noted deficiencies must be corrected before further tests are made.

2. Simultaneous visual inspection and functional tests to avoid the necessity for a second run-through unless deficiencies are found.

The sequence is basically a matter of personal preference and will be dependent upon such factors as available manpower and the size and complexity of the installation.

Regardless of sequence, the following procedures are recommended:

Visual Inspection

Check the following for compliance with applicable codes and standards:

a. All components installed in a workmanship manner.
b. Secure mounting of all components.
c. 48 inch mounting heights and locations of manual fire alarm boxes.
d. Locations and spacing of smoke detectors in compliance with NFPA 72, Chapter 5.
e. Locations of heat detectors and spacings in compliance with NFPA 72, Chapter 5 and rated spacing per SFM listing data.
f. Temperature ratings of fixed temperature or combined fixed temperature - rate-of-rise detectors in relation to ambient temperature values. (NFPA 72, Chapter 5)
g. Locations of audible/visual notification appliances.
h. All equipment SFM listed and labeled by a recognized testing laboratory. (Label exception: batteries)
i. Exposed cables UL listed as power-limited or non power-limited as related to the identification of control unit terminals and as specified by Article 760 of Part 3, Title 24, California Electric Code.

j. Junction boxes suitably identified as fire alarm.
k. Cables or conduit suitably fastened and supported.

Monitoring for Integrity Tests (formerly termed "electrical supervision")

The most common errors made in Fire Alarm installations are in the wiring of the components and incorrect sequence of wiring circuits.

This is particularly true of traditional Zone type installations as opposed to Addressable types. This will be described in further detail later.

Such errors are not usually obvious, as all elements of the system may respond satisfactorily to tests. If the installation is not wired properly however, the ability of the control panel to monitor these circuits for integrity may be partially or totally impaired.

Under such circumstances, potentially disabling fault conditions in external circuits may not be detected as specified by NFPA 72, resulting in a possible system failure under emergency conditions.

Tests of the integrity monitoring features are therefore one of the most important aspects of the inspection and should never be neglected.

Should there be any valid reason to question the quality of an alarm installation, the number of verification tests on external circuits should be more extensive than recommended in the following guidelines.

It is also recommended that a record be made indicating the locations where integrity monitoring tests are made. This will avoid duplication if subsequent tests are considered desirable at a later date.

Power Supply Tests

Connections to the Commercial AC power source should consist of an independent branch circuit. Means for disconnection should be accessible only to authorized personnel and should be clearly marked as "Fire Alarm Circuit Control".

Request that the technician disconnect this power source and confirm that the control panel initiates an audible trouble indicating response.

A trouble silencing means is provided, and trouble indication must then be by visual indication when audibly silenced, such as the lighting of an amber indicating lamp or equivalent method. Many control units incorporate a normally illuminated green or white indicating lamp as a "power on" visual indication. This lamp will go off upon power failure or disconnection.

Secondary Power Supply (Stand-By)

All systems must be equipped with a secondary standby power supply as specified for specific system types and as outlined in Part I. In review, Local, Proprietary, Central Station, Emergency Voice/Alarm and Household all require 24 hours of standby power.

Auxiliary and Remote Station require 60 hours of standby power. All systems except Emergency Voice/Alarm and Household require an additional 5 minutes of alarm operation. Emergency Voice/Alarm systems require 15 minutes at full load alarm operation and Household requires 4 minutes of alarm operation.

There are two common methods for verification of standby battery capacity.

1. The more precise method is to arrange for the primary AC power source to be

disconnected either 24 or 60 hours (depending upon type of system) before the inspection is scheduled to begin.

The system should then be activated for alarm operation for the specified period of time (usually five minutes) and acceptable
operation verified.

Most frequently a local system will be involved, and there should be adequate levels of operation of all audible and visual notification appliances for a full 5 minutes.

The primary power must then be restored for the balance of the inspection.

2. When it is impractical to arrange for power disconnection in advance as described above, it can be disconnected for the entire inspection sequence providing that it does not exceed a single day.

While this cannot be considered a precise method of evaluation, it will generally serve the purpose and provide reasonable assurance of adequate battery capacity.

Initiating Circuit Tests

To verify monitoring for integrity capability, wiring connections to initiating devices should be checked to confirm that they are correct. Trouble conditions should also be temporarily introduced in the initiating circuits to confirm control unit trouble responses.

As time and logistics permit, wiring connections to all or a substantial number of initiating devices should be checked.

Have the technician remove the initiating device from the mounted position to expose the wiring connections. The act of removing a plug-in type device from the base, such as most models of smoke detectors, should cause a trouble condition at the control panel.

In accordance with applicable standards, and regardless of type, most initiating devices provide four (4) terminals or four (4) short wire leads for connection of the initiating circuit wires.

Verify that the initiating circuit wires are connected to both terminals in each pair of duplicate terminals or spliced to duplicate wire leads of the device as illustrated for correct wiring methods in Figure A-5-1.4(a) of NFPA 72, Appendix A.

Exception: A few manufacturers produce initiating and notification appliances with two (2) single terminals for circuit wiring connections rather than the usual four.

These devices are equipped with special notched clamping plate terminals with both incoming and outgoing circuit wires inserted beneath the plate and are CSFM listed as an acceptable alternative to the more common duplicate terminals. (Also illustrated in NFPA 72, A-5.1.4(a))

If incorrectly connected, [with two pairs of initiating circuit wires attached to single terminals or spliced to single wire leads as illustrated in Figure A-5-1.4(a)], the device will initiate an alarm when activated, but is <u>not</u> monitored for integrity, as connections can be removed without producing a trouble signal.

All such sub-standard connections must be corrected per Part 3 of Title 24 CCR, Section 760-10.1

Note: Any extra terminals or wire leads in excess of four, as provided on some initiating devices such as four wire smoke detectors, are for other purposes and need not be considered in this portion of the inspection.

While verifying correct wiring connections, have the technician remove an initiating circuit wire from a terminal or open a splice at a few strategic locations in each zone of protection. The control panel should respond with an audible trouble indication to each such test.

The most strategic locations for these tests are at building extremities such as the ends of corridors or wings, as illustrated in Figure 2 located in the back of this document.

Lack of a trouble response in any instance would indicate incorrect sequence of initiating circuit wiring or improper location of the EOL (end of line resistor), and would justify termination of the inspection, pending necessary corrective action.

At this point, any requirement for further tests would depend upon the class of the initiating circuit as identified in the documentation portion of the inspection.

Both Class A and B initiating circuits must provide trouble indication of a fault condition, but no further tests would be required of the Class B Circuit (styles A, B, or C) which is the type most frequently used.

In addition to trouble indication, the Class A Circuit (styles D or E) is designed to provide alarm response from all connected initiating devices with a single fault condition in the circuit, and further tests are necessary to verify this feature when this type of circuit is used.

1. With the initiating circuit wire still disconnected from the initiating device terminal, the audible trouble warning should be silenced (amber trouble lamp or equivalent visual indication should be on).
2. Have the technician test one or more initiating devices in the SAME zone to verify normal alarm response under circuit fault conditions.

   This may temporarily eliminate the trouble indication on some control units. The trouble indication should reappear when the alarm condition is restored to normal.

3. Restore the circuit connection to the initiating device and check the control panel for normal status.

Smoke Detector Power Circuit Tests

Unlike all other types of initiating devices, the smoke detector requires a source of power for its electronic components.

One type, identified as the "two-wire" smoke detector, derives all necessary power from the initiating circuit and does not require a power integrity monitoring test. This type of detector must be listed as being compatible with the control unit however, as noted under "documentation".

All other detectors, identified as 4 wire models, require a separate source of power from the control unit and provide additional terminals or wire leads for connection to a power circuit as illustrated in Figure A-5-1.4(b) of NFPA 72 Appendix A.

This power circuit should be temporarily disconnected from one or more smoke detectors at strategic locations similar to the initiating circuit tests, and a control unit trouble indication verified for each such disconnection.

Notification Appliance Circuit Tests

The appropriate locations for tests of notification appliance circuits are at building extremities in the same manner as for tests of the initiating circuits or smoke detector power circuits. The removal of a

wire from a terminal at any location should produce a trouble indication.

If the notification circuit being tested is classified as class A (style Z) the circuit should be left disconnected at some point and an alarm initiated to confirm normal operation of all notification appliances.

Also as with initiating devices, wiring connections to notification appliances should be checked to confirm proper terminal or wire lead connections.

Short Circuit Tests

Unlike other fire alarm circuits, the notification appliance circuit is additionally required to produce a trouble indication upon the occurrence of a short circuit condition.

A test to verify this response can be made at any point in the circuit by momentarily shorting across the two duplicate sets of terminals or single notched plate terminals if so equipped.

Ground Fault Tests

Additional integrity monitoring tests are necessary for control units providing optional ground fault detection which has become an almost universally adopted feature.

A ground fault is an abnormal electrical condition most frequently resulting from a bare wire coming in contact with a metal surface or moisture.

All necessary tests can be conducted at the control unit except for those systems which employ Class A initiating and/or notification appliance circuits.

For Class B initiating circuits, request that the technician momentarily "ground" each initiating circuit and notification appliance circuit in turn at the control panel terminals.

In each instance the control panel should respond with a trouble indication.

For installations with Class A initiating circuits, the temporary ground should be left connected to the initiating circuit under test while an initiating device in the SAME zone is operated to verify normal alarm response under circuit fault conditions.

Each Class A initiating circuit should be tested in this manner.

A similar test should be conducted for each class A notification appliance circuit to verify normal operation of all notification appliances with the circuit grounded.

Supervisory Circuit Tests (if applicable)

All supervisory circuits of automatic fire sprinkler systems are class B and have no style designations.

Trouble response tests for open or grounded circuit conditions should be conducted in the same manner as for class B initiating circuits.

Fire Safety Control Circuits (if applicable)

Except for circuits such as those used for magnetic door holders which function upon a loss of power, fire safety control circuits must be monitored for integrity.

There are currently no specific classifications for these circuits, but in general most are similar to sprinkler supervisory circuits and can be tested in the same manner.

ADDRESSABLE SYSTEMS (MULTIPLEX)

SYSTEM CONCEPTS

The addressable system uses a computer based control unit and may provide alarm annunciation of individual initiating devices.

This is different than the conventional zone type system which typically identifies only the floor or building section from which an alarm is initiated.

There are two distinct types of addressable systems. One uses the traditional standard type of initiating devices that are also used in conventional zone type systems.

These devices basically consist of normally open switches which close to initiate an alarm. Closure of the switch may be by mechanical means, such as the manual operation of a fire alarm box, by a water flow switch on a sprinkler riser or by a mechanically activated heat detector.

Alternately the switch may be closed through electronic detection of products of combustion such as by a flame or smoke detector or by electronic models of heat detectors.

The other major variation in the addressable system uses analog types of automatic fire detectors which must be UL and CSFM listed as being compatible with the specific control unit to which they are connected.

The analog type of detector consists of an electronic sensor which constantly monitors environmental conditions for variations in temperature, smoke obscuration or other conditions involving products of combustion and reports the related values of the data to the control unit. The control unit CPU then evaluates this information and, based upon the alarm sensitivity threshold values which have been programmed into it, makes the decision as to whether an alarm condition is indicated and reacts accordingly.

Only electronic types of detectors are adaptable to analog technology. Mechanical initiating devices such as manual fire alarm stations or water-flow switches can be used in analog type addressable systems, but they will function only as an off and on switch as they do in conventional systems.

Some major advantages to analog technology are:

1. Programmable sensitivity levels which allow setting less sensitive alarm threshold levels (during operating hours) when adverse environmental conditions are conducive to false alarms and a more sensitive levels during closed (non-operating) periods.

2. Detection of programmed pre-alarm thresholds indicating a need for detector service thereby reducing false alarms.

3. Indication of potential trouble conditions requiring service.

Either type of addressable system employs a "Signaling Line Circuit" for continuous two-way communication with the initiating devices.

To provide the means for data communication with the control unit, the initiating devices utilize electronic modules identified as "signaling line circuit interfaces".

Depending upon the manufacturer's design, this interface may be physically integrated into the initiating device or mounting base, or may be an entirely separate module requiring wiring connections to the initiating device.
(See Figure 3 located in the back of this document).

When a separate module is used, the wiring connection to the initiating device is still defined as an initiating circuit and permits more than one initiating device to be connected to a single interface module with all devices then being identified by a common address.

Such an application would be appropriate for 2 or possibly 3 detectors in a corridor or a large room where there is no advantage served by identifying each device separately.

This grouping arrangement with a single address, would not apply to analog detectors which cannot be connected in this manner or must be addressed individually.

The major wiring distinction in any addressable system is the signaling line circuit which provides the communication link for the transmission of signal data to the control unit to indicate an alarm, trouble, or supervisory condition and/or restore the system to normal condition.

In tests of addressable systems, satisfactory control unit responses to the activation of all initiating and supervisory devices will confirm that all devices are in communication with the control unit and capable of reporting emergency and/or trouble conditions.

Therefore, integrity monitoring tests are not necessary for these circuits unless they are classified as class "A" or styles 2a, 5a, 6a, or 7a as defined in 1993 NFPA 72, Table 3-6.1.

A class "A" circuit should be opened at some point and one device in each direction from that point activated to verify normal responses. Additionally, one device should be activated to verify response with a ground applied to the circuit.

Notification appliance and smoke detector power circuits for such systems should still be tested in the usual manner.

This is also true for sprinkler supervisory and fire safety control circuits when applicable.

ALARM RESPONSE TESTS

Initiating Devices

All initiating devices not previously tested as a portion of the monitoring for integrity circuit tests, should be tested in accordance with the specified procedures of NFPA 72, chapter 7.

In installations which include water-flow detectors, tests of wet-pipe systems must be made at the inspector's test valve for each sprinkler riser involved.

Due to delay factors which are characteristic of water-flow alarm detection in wet-pipe systems this valve should be fully opened and sufficient time allowed for water-flow alarm response. (a maximum of 90 seconds).

For life safety applications, the control unit alarm response to each initiating device should be:

A. Continuous operation of notification appliances until silenced or reset.

B. Control unit electrically "latched" in alarm condition until reset.

C. Annunciation of alarm source in multi-zone or addressable systems. The control panel must be reset after each individual test.

Note: Systems using alarm resound do not require resetting after each individual test to reinitiate further actions.

Control units designed for property protection are not required to electrically latch in alarm condition providing that the alarm signal is transmitted to the remote monitoring facility.

Such systems will restore automatically when the alarm initiating device is restored to normal status.

A. No notification appliances are required.

B. Alarm source identification is required.

Audible Alarms

In the course of the alarm tests, the sound levels produced by the audible notification appliances should be verified as being in accordance with the applicable code requirements.

The alarm should be distinct and clearly audible in all normally occupied areas, and as specified in applicable code requirements for the type of occupancy.

Good judgment should be used, and should there be a question as to adequate sound level at any location, a decibel meter reading may be a necessary requirement for a definite determination.

This meter should be set on the dB(a) weighted measuring scale and used first to measure the ambient non-alarm sound level in the areas in question.

The audible alarm sound level for "public mode" should be not less than 75 dBA at a distance of 10 feet from the notification appliance.

Also, it must not be less than 15 dBA above the ambient sound level or 5 dBA above the maximum sound level having a duration of at least 60 seconds (whichever is greater) throughout normally occupied areas.

Note: The above requirements do not apply to staff alerting systems employing chimes.

The criteria in such installations is that the audible alarm for "private mode" be not less than 45 dBA at a distance of 10 feet and of adequate volume to alert staff personnel only.

Remote Signaling (If Applicable)

In installations in which remote alarm signaling connections are included, a timing test should be made for each individual transmitter or communicator installed.

One initiating device associated with each transmitter or communicator should be operated and times of operation noted for later comparison with the times the signals are recorded at the remote monitoring facility.

Allowance must be made for delay factors in Water-flow Alarm responses when wet-pipe sprinkler systems are involved.

Only one timing test per transmitter or communicator is necessary to verify acceptable remote

signal transmission. If a control unit disconnect switch is provided, all other remote signals may be suppressed for the balance of the inspection tests.

Integrity of Telephone Lines

The vast majority of remote signaling connections are currently made by means of digital communicators which require connections to two "dial-up" telephone lines to the nearest telephone exchange, or one such telephone line supplemented by an approved method of radio transmission or cellular phone.

Telephone lines must be monitored by the communicator/control unit for integrity and failure of a line (number) must be indicated at the premises with a trouble signal being transmitted to the monitoring facility by means of the second line or alternate signaling path.

It is recommended that the technician be instructed to disconnect each telephone line in turn to verify a trouble indication which should occur within a maximum of four (4) minutes.

CONTROL UNIT AUXILIARY FEATURES

Annunciation

As alarm response tests of initiating devices are made, verify that the annunciator (and printer, if installed) responds in each operation and that zones or addresses are properly identified in relation to the actual physical location of the initiating device being tested.

Control Functions

One alarm response test should be made to verify that all related fire safety control functions operate as intended, such as release of fire doors, shut down of HVAC systems, etc.

> **Caution:** In those rare instances in which the control unit serves to activate special extinguishing systems, arrangements must be made to prevent discharge of the extinguishing agent prior to conducting this test.

For such applications the control unit is identified as a Releasing Device Control Unit and must be specifically listed for this purpose under CSFM listing category No. 7140.

Prior to any alarm testing, it should be determined if the initiation of an alarm will affect normal building functions such as elevator and ventilation systems.

If possible, arrangements should be made to conduct the tests when the disruption of these services may be minimal to the building occupants, and qualified personnel are available to restart any functions which my be disrupted.

Upon satisfactory conclusion of the test, the control unit disconnect switch for fire safety control functions should be operated to the "Off" position for the balance of the inspection to avoid repetitive and unnecessary disruption of building services.

With the switch in "off" position, there should be a control unit trouble indication.

Sprinkler Supervision

When sprinkler supervisory service is included, all related supervisory initiating devices should be tested to verify control unit responses.

Signals from control valve tamper switches should be initiated when the valves are operated a

maximum of two complete turns or one-fifth of the distance toward the fully closed position.

Each specific type of supervision must be individually annunciated for positive identification. A means must also be provided to distinguish between the abnormal indication and restoration to normal status.

Sensing devices employed for other forms of sprinkler supervision such as air pressure, water level, etc., will require simulation of the abnormal condition to verify responses to these conditions.

The control unit responses to tests of sprinkler supervision are to be identified as a supervisory signal, not to be confused with alarm or trouble signals.

THE FOLLOW-UP INSPECTION

In general, the scope of the follow-up inspection need not be as comprehensive as the acceptance inspection unless extensive alterations or additions have been made to the fire alarm installation.

Those portions of the installation affected by such changes should be thoroughly tested in accordance with acceptance inspection procedures.

For the balance of the installation which has not been altered, the following procedures are recommended.

PRELIMINARY PROCEDURES

Documentation - Any or all documents which were provided as a portion of the acceptance inspection should be available for review, if needed.

Additionally, acceptable evidence of periodic inspections by others should be available, if required by Code.

Orientation - The technician should be required to review the functions and any special features of the installation prior to functional tests.

Notification - The same procedures as used in the acceptance test should be followed to notify concerned parties.

INSPECTION SEQUENCE

The sequence is again primarily a matter of personal preference, based on the particular circumstances involved.

VISUAL INSPECTION

Having been evaluated and approved in the acceptance inspection, all details relating to locations, spacings, temperature ratings, etc., of initiating devices are not a matter of concern in the follow-up inspection.

Other factors assume vital importance however, and particular attention should be given to the following:

a. General appearance - Look for evidence of deteriorated or damaged components of the system.

b. Redecoration of premises - With rare exception, all types of heat or smoke detectors become inoperative or suffer a loss of sensitivity if painted and must be replaced.

c. Building alterations - New additions will obviously require additional protection, but less obvious and equally important are minor structural changes in areas protected by heat or smoke detectors.

Examples: partitions installed or relocated, drop ceilings installed or removed, etc. In nearly all instances additional detectors will be required for the areas involved.

MONITORING FOR INTEGRITY TESTS

Power Supply Tests

Tests of the power supply should be made in the same manner as in the acceptance inspection. The secondary stand-by power supply test is of particular importance to verify that the batteries are fully charged and have not deteriorated with age.

Monitoring for integrity tests of initiating circuits, smoke detection power supply, notification appliance circuits, other optional circuits, and ground fault detection, are not generally considered necessary in the follow-up inspection, but as a measure of precaution, it is recommended that one or two random tests be made at locations other than those previously involved in the acceptance inspection.

Alarm Response Tests

Initiating Devices - With the exception of water-flow detectors and sprinkler supervisory devices for which quarterly tests are specified, Chapter 7 of NFPA 72 requires that all initiating devices be tested semi-annually.

The actual number to be tested in a follow-up inspection will thus depend upon the frequency of such inspections and whether or not periodic tests are made by others.

Available time for the inspection is also a limiting factor and good judgment must be used.

Regardless of circumstances, if the installation is a small one with relatively few initiating devices, it is recommended that all be tested.

Audible Alarm Tests

Random sampling of alarm audibility levels in various locations is recommended for this phase of the inspection.

Remote Signaling Tests

Timing tests of all transmitters or digital communicators should be conducted in the same manner as in the acceptance test.

AUXILIARY FEATURES

Inspections and tests of the annunciator, fire safety control functions, and sprinkler supervision, where applicable, should be conducted as in the acceptance inspection.

FIRE ALARM SYSTEMS AND INSPECTION PROCEDURES

PART lll, INSPECTION CHECK-LIST - NEW SYSTEMS

SYSTEM INFORMATION & INVENTORY

The following information should be obtained prior to any testing of the system. Most of this information can be provided by the technician prior to the test:

1. Name and address of building or premise.

2. Name of building owner and/or manager and name of person responsible for the operation and maintenance of the system.

3. Name of installing contractor, including address and phone number.

4. Local building and/or electrical permit number(s) under which the system was installed.

5. Does the system transmit signals to a remote location?
   a. Name and phone number of the monitoring facility.

   Obtain information regarding services provided and length of contract. Type(s) of signaling method/s used.

   Confirm that the monitoring facility has the CORRECT telephone number/s for retransmission of alarms to the fire department.

6. Name, address and phone number of company providing testing and/or maintenance service.
   a. Is this service a code requirement?

   Obtain information regarding services provided and length of contract.

7. System installed under which codes (local/state building and electrical and applicable dates.)

8. General description of system and inventory of all equipment and devices associated with the system.

   For all devices and equipment listed below, obtain the following information:

   A. Quantities Installed - Brand Names, Model Numbers, and State Fire Marshal Listing Numbers.

   B. Control Unit - Location, number of zones or addresses, Class A or B initiating, signaling line, or notification circuits and their style designations. Ground fault detection, fire safety control functions, auxiliary features.

   C. Annunciation - (include remote panels, if any). Locations and number of zones or addresses and descriptions.

   D. Manual fire alarm Boxes - General description of locations, coded or non-coded.

   E. Automatic Detection Devices - Total or Selected coverage. If selected, a brief description of locations: (i.e. air ducts, elevator lobbies, halls, mechanical rooms, etc.).

F. Types of devices - Smoke Detectors, ionization, photoelectric, spot or beam; heat-rate-of-rise, fixed temperature, combination, other.
Evidence that 2 wire smoke detectors are listed as compatible with the control unit. (Specify temperature ratings when applicable and spacing requirements.)

G. Water-flow Devices - Locations.

H. Other fire suppression systems connected to control unit and locations - Halon, hood and duct systems, etc.

I. Audible Alarms - Type (bell, horn, siren, speaker, etc.); Full coverage or partial coverage (if partial, specify locations). Type of audible alarm (general, selective, staff alerting, pre-signal, positive alarm sequence.)

J. Visual alarms - Locations and candela ratings of strobes.

K. Voice/Alarm Communication System - Number of speakers and areas of coverage. General alarm, selective (relocation) or both.

L. Fire Safety Control Functions - Obtain details and sequence of operation. Automatic door releases; fan motor shutdown, elevator recall, etc. Operational matrix or general description of each.

M. Supervisory Circuits and Devices - Identify sprinkler supervision for control valves, fire pumps, water levels, air pressure, etc.

9. Primary power supply detail: Location of source.

10. Secondary (standby) power source detail: Generator or batteries.

A. For Generators - Automatic or manual, capacity, type of fuel, fuel supply and running time.

B. For Batteries - Ampere hour capacity, type, voltage.

NOTIFICATION PRIOR TO TEST

The following should be notified prior to any test:

1. The building owner and/or management, preferably forty-eight (48) hours before the test.

2. The occupants of the building, if audible alarms are to be sounded. Notice should be given twenty-four (24) hours prior to the test and also the day of the test.

It is recommended that signs be posted at the building entrances and in all elevators.

3. Building staff, building engineers, security, PBX operators, etc.

4. Fire Department Dispatch Center.

5. Central Station or other monitoring facility.

REQUIRED INFORMATION AND DOCUMENTS

1. "As Built" plans on the premise(s).

2. Control unit wiring diagram inside unit.

3. Operator's Manual at control unit.

INSPECTION TESTS

CONTROL UNIT, ANNUNCIATOR & TRANSMITTER

1. Is there a person from building management who will be responsible for the system and is he/she properly trained and knowledgeable in the operation of the system?

2. Are the zones or addresses properly identified? (Control unit and/or remote annunciator panel(s).

3. Is the green power light on?

4. Does the panel indicate normal conditions?

5. Are all the indicating lamps functional?

6. Does the trouble signal operate - audible, visual?

7. Is the trouble audible distinctly different from alarm audible?

8. Does the trouble silence switch silence the trouble audible while leaving visual indication of trouble?

9. Does the alarm silence switch silence the audible alarm while leaving the visual indication of alarm until the system is reset?

10. Do alarm and trouble reset switches operate properly?

11. Do other optional control switches operate properly? (i.e. test or drill switch to simulate alarm condition, lamp test switch, etc.)

12. If a disconnect switch is provided for fire safety control, does operation to "off" position cause a trouble indication?

POWER SUPPLY - INSPECTION & TESTS

1. Is the primary power disconnect switch mechanically locked and located so as to be accessible only to authorized personnel and clearly marked "Fire Alarm"?

2. Does control unit indicate trouble when the primary power supply is disconnected?

3. Is there reasonable assurance that the standby battery capacity is sufficient to maintain the system for the specified standby period and also operate the system in alarm condition for five (5) minutes?

Note: Fifteen (15) minutes at full load for Voice/Alarm systems.

ALARM INITIATING DEVICES

1. Did each circuit indicate trouble when an initiating device wire was disconnected?

2. Did ALL initiating devices, when activated, cause an alarm condition?

3. Are All initiating devices properly wired?

4. For Class A systems, will an activated initiating device cause an alarm condition while a single open or ground fault exists on the circuit?

5. For 4 wire smoke detectors, is a trouble indication initiated when the power source is disconnected from a detector?

6. Are all initiating devices installed in a good, workmanship manner and securely mounted?

7. Are manual boxes properly spaced, visible, in the path of exit travel, and the operable part of the box is not less than 3½ feet nor more than 4½ feet above the floor? (See Section 5-9.1.1 NFPA 72, 1993 Edition)

   Note: Where wheelchair access would be limited to front access only, ADA requires a box mounting height of 48 inches.

8. Are all smoke and heat detectors mounted and spaced according to the applicable codes and standards?

9. Is all wiring installed according to the applicable codes and standards?

10. Are there any other circuits in the same raceway with the fire alarm circuit conductors, which are not permitted per code? (Article 760, Part 3, Title 24).

11. Did the annunciator respond to each initiating device with the proper zone or address identification, if applicable?

12. Are all smoke detectors a minimum of 3 ft. from H.V.A.C. supply registers?

SIGNALING LINE CIRCUITS

1. Did the control unit respond to tests of all initiating devices?
2. Were all initiating devices correctly annunciated?

NOTIFICATION APPLIANCE &CIRCUITS

1. Did each notification appliance circuit indicate trouble in response to open, ground, and short circuit fault tests?

2. Is the alarm distinct and clearly audible (15 dBA above ambient noise level or 5 dBA above maximum sound level of 60 seconds or more in duration) throughout all normally occupied areas?

3. Did all notification appliances operate as designed per floor, building, zone, etc.?

4. Are the notification appliances properly located and installed in all areas as required by applicable codes and standards?

5. Is all wiring installed according to the applicable codes and standards?

6. Are there any other circuits in the same raceway with the notification appliance circuit conductors, which are not permitted per Code?

7. Did all notification appliances connected to Class A circuits function properly under simulated fault conditions? (open and ground)

AUXILIARY FEATURES

Fire Safety Control Functions

1. Did all fire safety control functions operate as designed during an alarm condition (fire doors close, HVAC system shut down, etc.)?

2. Did the control unit indicate trouble when open and ground fault conditions were simulated in fire safety control wiring circuits?

Note: Not applicable to fire safety control functions which operate upon a loss of power. (i.e., magnetic door holder circuits)

Sprinkler Supervision

1. Did control unit respond with supervisory signals and appropriate annunciations when all supervisory devices were activated (valve tamper switch, low water, etc.)?

2. Was there a means to distinguish between each abnormal condition and restoration to normal condition?

3. Did the control unit provide trouble indications of simulated open and ground fault conditions in supervisory circuits?

INSPECTION TESTS COMPLETION

1. Did the remote monitoring facility, if applicable, receive all transmitted signals?

2. Did the time/s of receipt of signal/s reasonably correspond with the noted time/s of transmission?

3. Was the system reset for normal conditions?

4. Was the system restored to operational service?

5. Were all parties, who were earlier notified of the test, advised that the test has been completed?

FIRE ALARM SYSTEMS AND INSPECTION PROCEDURES

PART IV, INSPECTION CHECK-LIST - EXISTING SYSTEMS

SYSTEM INFORMATION & INVENTORY

1. Update information regarding building owner, management, and person responsible for the system.

2. Is responsible person knowledgeable of the operation of the system?

3. Have there been any additions, deletions or alterations to the system since the last inspection? If so, update the basic system information and inventory sheets to include all changes. Also, obtain the following information for all changes:

   A. Contractor's name, address, and phone number.

   B. Permit number(s) for work.

   C. "As Built" plans or corrections to existing plans.

   D. Codes and Standards used. Give name and/number and edition.

Note: Any new additions to the system should be tested in accordance with Acceptance Test Procedures.

4. Update information for any maintenance and/or testing, and supervisory contracts.

5. Are there records of monthly tests?

6. Are the required information and documents on the premise(s): ("As Built" plans, Control Panel wiring diagram(s), Operator's Manual)?

NOTIFICATION PRIOR TO TEST

Notification procedures should be the same as for the acceptance inspection and tests.

INSPECTION TESTS

CONTROL UNIT, ANNUNCIATOR & TRANSMITTER

1. Follow the same guidelines and inspection procedures as for the Acceptance Inspection and Tests.

POWER SUPPLY

1. Follow the same guidelines and inspection procedures as for the Acceptance Inspection(s) and Test(s).

2. If batteries are used as the secondary power source, are they fully charged and in good condition?

3. Have all secondary power sources been properly and regularly tested and maintained? Are records available for verification?

ALARM INITIATING AND/OR SIGNALING LINE CIRCUITS & DEVICES

1. Do records indicate that all circuits and devices have been tested in accordance with code requirements?

2. Did random testing verify that the circuits and devices are working properly?

3. Have all initiating devices been maintained in good condition and detectors kept clean?

4. Have building alterations, remodeling and/or redecorating taken place which necessitates the relocation, addition or replacement of devices?

NOTIFICATION APPLIANCE CIRCUITS &DEVICES

1. Do records indicate that all circuits and devices have been tested in accordance with Code requirements?

2. Did random testing verify that the circuits and devices are working properly?

3. Did random testing verify that the audibility has been maintained at a minimum of 15 dBA above ambient noise levels?

4. Have building alterations, remodeling or redecorating taken place which necessitate the relocation of devices or addition of new devices?

AUXILIARY FEATURES

1. Did all fire safety control functions operate as designed during an alarm condition (fire doors close, HVAC system shut down, etc.)?

2. Did control panel respond with a supervisory signal and appropriate annunciation when all sprinkler supervisory devices were activated (valve tamper switch, low water alarm, etc.)?

INSPECTION TEST COMPLETION

1. Follow the same guidelines and inspection procedures as for the Acceptance Inspection and Tests.

FIRE ALARM SYSTEMS AND INSPECTION PROCEDURES

PART V, GLOSSARY OF TERMS

ACTIVE MULTIPLEX SYSTEM

An active multiplex system in one in which transponders are in constant two-way communication with a control unit and report status changes of initiating devices or initiating device circuits within a prescribed time interval.

ADDRESSABLE DEVICE

A fire alarm system component with discreet identification that can have its status individually identified or that is used to individually control other functions.

ALARM

A warning of fire danger.

ALARM PILOT LAMP

A control unit lamp which lights when an alarm is initiated. Usually red in color.

ALARM SILENCING SWITCH

A control panel switch for silencing of the audible notification appliances and where applicable, stopping the operation of alarm indicating strobe lights.

ANALOG DETECTOR

A detector used in some addressable systems which signals varying degrees of conditions (i.e. smoke or heat) as contrasted with a conventional detector which only indicates an on or off condition.

ANNUNCIATOR

A unit containing one or more indicator lamps, alpha-numeric displays, or other equivalent means in which each indication provides status information about a circuit, condition, or location.

ALARM VERIFICATION FEATURE

An alarm initiating delay feature restricted to smoke detectors, in which the alarm condition must persist or be repeated during a predetermined grace period before the control unit is activated for alarm response. (Limited to 30 seconds in California)

ALERT TONE

An audible signal to alert building occupants preceding an emergency voice/alarm message.

CENTRAL PROCESSING UNIT (CPU)

Microprocessor based fire alarm control unit/panel used in active multiplex fire alarm systems.

CIRCUIT INTERFACE

A circuit component that interfaces initiating devices and/or control circuits, indicating appliances and/or circuits, system control outputs, and other signaling line circuits to a signaling line circuit.

CONTROL SWITCHES

Control unit switches provided to silence the audible alarm or trouble warning, to reset the system, for test purposes, or for control of auxiliary features.

DISCONNECT SWITCH

A switch used to cut off the primary AC power supply at the source, or a control unit switch for fire safety functions. (Sometimes called "shunt", "cut-off" or "auxiliary" in control unit applications).

DETECTOR

An automatic alarm initiating device which is activated by products of combustion such as smoke, heat, flame, gas, or by the flow of water through an automatic sprinkler system.

FAULT

A condition indicated by a Trouble Signal resulting from trouble of any nature such as power supply problems or an open, ground, or short in wiring circuits associated with a fire alarm system.

FIRE ALARM CONTROL UNIT (PANEL)

A system component which monitors the status of input circuits, alarm initiating devices and power supplies and provides output signals to alert building occupants and/or responsible personnel of alarm, trouble or supervisory status changes.

FIRE ALARM SYSTEM

A system of electrical devices and circuits installed, arranged, and maintained to form, transmit, and sound signals indicating an emergency requiring immediate action to safeguard life and property from fire.

FIRE SAFETY CONTROL DEVICE

The fire alarm system component that directly interfaces with the control system for a fire safety function. (i.e.,control unit for air handling fan motors, elevators, etc.)

FIRE SAFETY FUNCTIONS

Building and fire control functions that are intended to increase the level of fire safety for occupants or to control the spread of harmful effects of fire. (i.e., elevator recall, release of fire doors, HVAC control, etc.)

GROUND

A conducting connection between an electrical circuit or equipment and the earth.

GROUND FAULT

An abnormal electrical connection established between electrical system components and the earth. Usually due to electrical contact with a metallic surface or moisture.

GRAPHIC ANNUNCIATOR

A custom-made annunciator consisting of a plot plan of the protected premises with visual alarm indicators located to correspond with physical locations of related initiating devices.

INITIATING DEVICE

A manually operated or automatically activated device designed to initiate a control unit alarm condition. (See "Manual Fire Alarm Box" and "Detector".)

LOCKING OR "LATCHING" FEATURE

A design characteristic of a Fire Alarm Control Panel which causes the alarm condition to remain after the initiating device which caused the alarm has restored to normal non-alarm status. A reset switch is provided to restore the panel to normal condition.

Note: Some control units also "lock" into trouble condition when a system fault is detected, and until reset to normal status.

MANUAL FIRE ALARM BOX

A manually operated fire alarm initiating device, sometimes called a "Manual Pull Station".

MONITORING FOR INTEGRITY (formerly "electrical supervision")

A control unit feature in which the electrical status of both the power supplies and externally connected circuits are monitored to detect any potentially disabling fault conditions and to activate a trouble signal to indicate such a condition.

MULTIPLE STATION DETECTOR (see single station detector)

Two or more single station detectors that may be interconnected so that the actuation of one causes all integral or separate audible alarms to operate. May also consist of a single station detector having connections for other detectors or a manual fire alarm box.

NOTIFICATION APPLIANCE (formerly "indicating appliance")

A fire alarm system component such as a bell, horn, speaker, strobe, printer, etc. which produces an audible or visual output or both.

PILOT LAMP

A colored status indicating lamp in a control unit or annunciator.

POWER PILOT LAMP

A control unit lamp (usually green) which is normally on to verify the connection of the commercial AC power primary power supply.

POWER SUPPLY

A source of electrical energy for the fire alarm system, consisting of primary and secondary (standby) power sources.

PRIMARY POWER SUPPLY

The commercial AC source of power normally used to supply the electrical energy requirements

of the fire alarm system and maintain the secondary standby battery source (when used) in fully charged condition.

RESET SWITCH

A control panel switch provided to restore the system to normal non-alarm status following an alarm.

RING-BACK FEATURE

An audible trouble signal to indicate the abnormal position of a control panel switch.

SECONDARY POWER SUPPLY

An emergency stand-by source of power for the fire alarm system in the event of the failure of the primary supply. (Usually consists of batteries maintained under charge, but may consist of an Emergency Generator).

SINGLE STATION DETECTOR

A completely self-contained automatic alarm initiating device incorporating detector, control equipment and audible alarm device in one unit operated from a power supply in the unit or at the point of installation. (typical of household smoke detectors)

SPRINKLER SUPERVISION

A method of electrically monitoring critical elements of an automatic sprinkler system to detect potentially disabling abnormal conditions and provide supervisory signal indication to alert responsible personnel.

SUPERVISORY SIGNAL

A signal indicating abnormal status of a critical element of an automatic sprinkler system such as control valve closure, low pressure, low water level, etc.

TEST OR "DRILL" SWITCH

A Control unit switch which provides the means to simulate the activation of a an initiating device and verify alarm output response.

THERMOSTAT or THERMAL DETECTOR

Another term for "heat detector".

TRANSMITTER

An electro-mechanical or electronic device designed to transmit coded signals to a remote monitoring facility.

TROUBLE PILOT LAMP

A control panel lamp which lights when a fault condition is detected in the fire alarm system. (Usually amber colored)

TROUBLE SIGNAL

A signal indicating a fault condition in external wiring circuits or in the power supply.

TROUBLE SILENCING SWITCH

A switch for silencing of the audible trouble indication until necessary repairs can be made.

WATER-FLOW DETECTOR

A device designed to detect the flow of water through an automatic sprinkler system riser as will occur when one or more sprinkler heads have operated.

ZONE

An annunciated area of fire alarm protection. (i.e. A floor of a multi-storied building or a warehouse area divided by separation walls.